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ABSTRACT

Standards-driven school reform is the national strategy to raise U.S. schools to a world-class level by the year 2000. Schools and school districts must develop plans, that show how to integrate the sets of national goals, standards, and assessments. This paper describes a school-improvement model (SIM) developed by the Gilbert (Iowa) Community Schools, National Computer Systems (NCS) Corporation, and the College of Education at Iowa State University. The paper first reviews research on cognitive competence and outcomes-based education (OBE). It then applies cognitive theories and constructivist strategies to learning and student assessment. Stages of the SIP program's review- and curriculum-development process are described. The final section describes the management information system that ties student outcomes to educational objectives and leads to curriculum revision. It is important that teachers have access to the management system. The management system benefits the school improvement process in that it communicates clear expectations and progress toward those expectations to teachers, students, and parents. Two figures are included. (LMI)

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STANDARDS-DRIVEN CURRICULUM REFORM AND A COMPUTERIZED ASSESSMENT PROCESS

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At "CONNECTIONS" the AASA National Conference on Education

Saturday, February 11, 1995

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Standards-Driven Curriculum Reform and a Computerized Assessment Process

William Butler Yeats once said, "Education is not the filling of a pail, but the lighting of a fire." The GOALS 2000: Educate America Act will probably start some fires and fill some pails!

Let's review our eight goals:

- All children will arrive at school ready to learn.
- The high school graduation rate will increase to at least 90 percent.
- Students will master challenging subject matter.
- Teachers will have access to training programs to improve their skills.
- U.S. students will be first in the world in math and science.
- All adult Americans will be literate and able to compete in a global economy.
- Every school will be free of drugs and violence.
- Every school will strive to increase parental involvement and participation in their children's education. (H.R. 1804, "GOALS 2000: Educate America Act," March 21, 1994)

I want to build upon a medical analogy today. When I was young, a doctor could check my brain by:

- feeling the bumps on my head,
- looking in my eyes, ears, and throat with a flashlight, and
- checking my reflexes with a rubber hammer.

Today we have CAT scans and magnetic resonance imaging! What we're doing in this seminar is an attempt, with the help of NCS, to move the technology for teachers from hammers and flashlights to MRI.

Why do we need standards-driven reform? We've had two waves of reform -- neither worked. The United States is moving toward becoming a nation of education haves and have-nots. This might be tolerable in England with its caste system, but in this country it is not only morally wrong -- but it's tantamount to planting a social time bomb.

In an increasingly competitive global society, one where information is power and where "learning is the new form of labor," we can't afford to stumble again. The first two waves of reform each took a pitfall!

The reforms triggered by "A Nation at Risk" contained no new ideas. It was a definite stumbling. We were to have more required courses, more standardized tests, a longer school year, and more money for teachers.

We are asking schools to prepare students, all students, for demanding, fast changing jobs of the future -- with the rigid structure and teaching methods designed for the factories of the early industrial age.

What we're about nationwide and here in this audience today is undoing the work of Fred Taylor and Henri Fayol. They proposed at the turn of the century a centralized, hierarchical style of management, with a rigid sense of time, and an accountability system based on loyalty to the system. We are still doing it today!

This was perhaps best personified by an anecdote told on my campus. A young art major told me of a class where they lectured to him about creativity and then measured his creativity with a true/false test.

The paradigm has shifted from "Education is Teaching" to "Education is Learning." How many times you've heard people say, "I taught my kid to swim, but he still sinks to the bottom." That wasn't teaching, that was talking about it.

Chester Finn and his colleagues in the U.S. Department of Education had a wonderful idea for wave three reform; set standards, deregulate schools and hold them accountable.

Nationwide, I expect a continued deregulation of schools, but unfortunately, in many cases without accountability. We do have to redesign America's schools, but we can't have true freedom for schools without accountability. In fact, the movement of reform is a search for new ways of doing things that will make both students and teachers accountable. Graduates ought to be able to use their education in real-life situations. Rick Stiggins and Grant Wiggins have shown us some interesting ways to do that!

Students aren't foolish. They know about winning carrots and avoiding sticks. What we're trying to do is force students to take more responsibility for their own learning. Curricula must become more focused, because we're now asking about the performance of every student, not just the elite.

Teachers are not likely to be willing to accept responsibility for student achievement unless they have some control over what's happening in the classroom. We need a culture of responsibility, with teachers who plan and evaluate their own work.

What we're about to launch, both in this room and nationally, is a serious U.S. debate about curriculum. We've never really had a serious U.S. debate over curriculum, because we've allowed the norm-referenced test makers to conduct the debate on our behalf.

Now, with the Educate America Act and the national goals and standards which are being produced, we now are establishing goals, deregulating the system, and hoping to produce new forms of accountability.

This is perhaps very fitting -- the frontier is closed. We can't depend on our ecology any more as a nation, we now must live with what comes out of our heads, just as the Japanese do.

Standards-driven school reform is the national strategy to raise U.S. schools to a world-class level by the year 2000. Standards for seven more core content areas will quickly follow the mathematics, social studies, and science standards presently available. These standards are not simple directions from the top; they must be translated at the state and local planning level into curriculum and instructional delivery systems. What we have is a monumental task analysis job to do.

Schools and school districts need a plan, a well-designed series of steps and examples, which shows how to integrate the sets of national goals, standards, and assessments being prepared by the various scholarly organizations into local planning, teaching, and assessment procedures. They

need a "local control" model which is an efficient guide that has been thoroughly field-tested for validity. We think the SIM approach is that model. A collaborative partnership including the Gilbert (Iowa) Community Schools, National Computer Systems (NCS) Corporation, and the College of Education at Iowa State University has been formed to develop and test such a model. The project is based upon 15 years of research by the School Improvement Model (SIM) research team at the ISU College of Education.

At the national level, Richard Riley, Secretary of Education, and President Clinton intend to jump start GOALS 2000, the goals set by then-President George Bush and the nation's governors in 1989, by the first education bill of their administration, the "GOALS 2000: Educate America Act."

The GOALS 2000: Educate America Act will tie federal dollars to goals as well as to the so-called "school delivery standards" that are to measure the conditions needed in schools to allow students to meet academic standards. You will hear a lot about "opportunity to learn" in the coming months. The proposed school delivery standards also include the specification of assessments and an accountability for reporting to the local public and the U.S. Department of Education.

To make matters even more complicated, regardless of whether you have a GOALS 2000 grant, numerous groups are hard at work setting goals and standards. These groups also recommend means of assessment. The mathematics, science, geography, and civics reports are now available. During 1994-95, the U.S. Department of Education is funding standards projects in the following areas: the arts, civics, English, foreign language, history, mathematics, and science. The National Council for Social Studies and the National Council on Economics Education are working on their own to set standards in their disciplines. Imagine what it will be like when all of these goals and standards arrive in the mail! We all want world class schools, but how can we have them without swamping teachers and administrators in a sea of change?

Each report, filled with goals, standards of performance, and suggested assessment techniques, will be dumped, one after another, on someone's desk. All of these reports target the year 2000 for implementation. What should be done? We must start with an understanding of the nature of cognitive competence.

COGNITIVE COMPETENCE

There has been a revolution in the social sciences in the past twenty years. The revolution has been our knowledge of the nature of cognitive competence and the long path that leads to its attainment. This new knowledge tells us much about how we should create curricula, teach, and assess student performance. In psychology, the once firmly entrenched behaviorism of Thorndyke, Watson, Hull, Spense, and Skinner has given way to several generations of mind as information processing system (Gardner, 1987).

Research in cognitive and skills learning has dramatic importance to curriculum design, delivery, and assessment. Unfortunately, the religious

fundamentalists who have attacked Outcome-Based Education have almost no knowledge of this revolution and practicing private school teachers have little more.

Admittedly, implementation of modern views of learning in public schools is equally sketchy. David Lohman suggests three reasons for this slow progress despite enthusiastic acceptance by most professional educational organizations. (1) Many educators were well trained in methods based on behaviorism, particularly the theories of Skinner. Such well-entrenched beliefs are difficult to change, especially when the evidence which challenges the theory comes from texts, articles, and other printed materials. (2) Even teachers who were trained in recent years often have only the barest exposure to modern theories of thinking and its development. (3) Those who have been trained thoroughly in modern instructional psychology soon find they must work in an educational system built on the foundation of behaviorism (Lohman, 1993).

Indeed, those of us who have taught for forty or more years will attest that many of the key features of the curriculum classroom organizations, and student evaluation have not changed much since we were trained in the 40's. Beliefs about the need for reinforcement, behavioral objectives, individualized instruction, and objective tests all are rooted in the work of Edward Thorndyke and his "Law of Effect." In his view, memory consisted of a vast collection of specific responses to specific stimuli. Transfer depended on whether two situations shared the same stimuli elements. Broad transfer was an improbable goal using these concepts.

In cognitive theory, the organization of knowledge and transferability of skill are paramount. Most cognitive theories distinguish several different types of memory systems, different types of memory codes, and different types of mental processes that operate on the learning task.

Many theorists distinguish between fact knowledge and skill knowledge. This basic dichotomy has several important implications for curriculum development and assessment. The critics of OBE from the religious right say they want a return to the basics and more rote learning. Unfortunately, the problem is not the learning of facts but the learning of thousands of disconnected facts.

> In spite of frequent claims to the contrary by some educators, much of education consists of an attempt to impart factual knowledge to students. Research in cognitive psychology tells us that the single most important thing we need to know about a student's factual knowledge is how richly and flexibly the student has organized this knowledge. Such organizational schemes show that the learner has distinguished main ideas from less important ideas from details, and has related this new knowledge to old knowledge . . . .
>
> Research also suggests that, contrary to much current educational practice, when learning factual knowledge, a good motto is 'less can be more.' Students in elementary biology are

> expected to learn thousands of technical, unfamiliar terms, to relate them to each other, and to apply this knowledge to problems in other domains. A thorough understanding of a smaller set of main ideas is much better than a vague and piecemeal understanding of a much larger set of ideas. (Lohman, 1993)

The spokespeople for the religious right who rail against the whole language approach to reading and insist upon much drill in phonics are clearly following behaviorist views from the past (Manatt, 1995).

Learners usually achieve transfer only after much experience in applying newly acquired knowledge to an increasingly diverse array of problems. This means that teaching for transfer requires constant review within and between possible domains. Lohman argues that this is probably impossible to achieve unless teachers know what students are learning in other classes and content domains, and actively encourage them to discover relationships among domains. Compartmentalization of teaching leads to compartmentalization of knowledge. That has been what OBE experts have been saying all along.

COGNITION, CURRICULUM, AND TESTING: FROM CORRELATIONS TO CAUSES

John Bruer, in his delightful new book *Schools for Thought* , likes to use the medical doctor metaphor as I did earlier in this speech.

Imagine that a paramedic squad has just rushed you to a hospital emergency room. You tell the attending physician you have severe chest pains, shortness of breath, and numbness in your left arm. The doctor notes these symptoms and examines you for others. He then says, "There is a 70 percent chance you will be dead within 4 hours. You appear to have some general, life-threatening physical deficiency." On the basis of his clinical experiences with hundreds of other patients, the doctor may have made a highly reliable prediction. He derives his prediction from extensive knowledge about statistical correlations between symptoms and outcomes.

Now imagine that is <u>all the doctor could say or do</u> . Imagine that the science underlying medical practice consisted entirely of unexplained statistical relations between symptoms and outcomes. If so, doctors could give prognoses, but could make no diagnoses. Therapies and preventive measures would, at best, be based on other unexplained correlations, on common sense, or on unfounded speculation. Fortunately, biological science supports medical practice. Biology helps explain symptoms in terms of internal, unobserved bodily processes. The doctor wouldn't say you had a general physical deficiency. He'd say you had a heart attack that damaged certain coronary tissues, and that this condition should respond to specific treatment. The doctor could even suggest some preventive actions, such as changing your diet and exercising, to help you avoid future coronary events.

Many of our educational assessment tools, particularly standardized aptitude and achievement tests, rely on unexplained statistical correlations. This leaves the teacher-student relationship at the same level as the doctor -

patient relationship in the imaginary heart attack. Our tests, which are based on many other cases we have observed and on statistical relations among them, allow us to compare and rank students by their relative academic health and to make predictions about educational outcomes. They allow us to attribute unfavorable outcomes to general intellectual deficits, but they don't help us make educational diagnoses, begin informed therapy, or prescribe preventive measures.

Because we have cognitive theories and have the idea of "constructivism" as a strategy, we can now support new approaches to student assessment. The study of cognition has attempted to explain observed differences in intelligent human performance in terms of internal mental mechanisms. This cognitive science is to education what biology is to medicine. Cognitive mechanisms underlie and cause the statistical correlations we measure with standardized tests. If we know what causes the correlations, however, we can make diagnoses, prescribe appropriate learning therapy, and identify preventive measures. We can use tests not only to measure learning but also to improve it.

Standardized test scores can't diagnose what might be wrong with teachers, schools, or the educational system. Falling test scores suggest that something may be amiss, but the scores themselves can't tell us what the problems are or how to fix them.

Cognitive science offers a different theoretical basis for testing and evaluation, one that can provide diagnostic information to complement standardized, norm-referenced tests. Cognitive science offers a theory and methods to describe what is behind students' performances -- what is causing the symptoms -- within a subject domain. Cognitive theory attributes differences in performance to specific differences in mental representations and processes. Cognitive scientists might start out comparing experts and novices, but they also can, and do, describe the intervening levels of competence and how that competence develops. They offer us a developmental psychology of performance changes.

If we can develop tests to trace changes in performance, we can trace students' learning trajectories in school subjects. We can describe their progress in terms of the representations they have and the mental processes they use. This is the information we need for educational diagnosis, therapy, and prevention. To underscore this different theoretical approach to testing, cognitive scientists sometimes call the new approach <u>learning assessment</u> rather than achievement testing.

The cognitive theory of learning assessment is in its infancy. Widespread adoption and application will require much more work and is likely more than a few years away.

Most instructional design efforts involve a minimum of four components; namely, a specification of (a) the goals to be met, (b) materials to be used, (c) teaching strategies to be employed, and (d) items and procedures for assessment. These components seem to be important for any domain of instruction imaginable. Specific curricula involve specific values for each of

the four components of instruction. Thus, curriculum designers often specify in great detail the goals, materials, teaching procedures, and assessments. The strength of such well-specified efforts is that they make a complete curriculum package that is relatively easy to implement and evaluate. There is also a potential problem with such efforts. The more complete the specification of the values for each instructional component, the less inclined teachers may be to map into the unique features of particular students and communities.

CONSTRUCTIVISM

Constructivism is what we call the strategies developed by the cognitive revolution. Constructivism says that students design their own learning. They construct it. Constructivism is the basic philosophy driving the integration of curriculum in the '90s.

To adopt constructivism almost requires an epiphany, a burning bush to convert a person trained in traditional instructional design systems.

The traditional approach to schooling has reflected a view of knowledge as entities existing independent of the learner or any context. Since knowledge exists independently, understanding can be objective, absolute, and unconditional. Cognition, in this view, is regarded as the rule-based manipulation of symbols via processes that will ultimately be describable through the language of mathematics and logic.

We are now beginning to see a change in the basic epistemology of schooling. A constructivist epistemology argues that knowledge is not acquired as a collection of abstract entities but rather is constructed in the context of the environment in which it is encountered. Context is integral to understanding; meaning arises from context and context is an integral part of that meaning. People construct knowledge socially, through collaboration and discussion. It is this social process that results in shared meaning and understanding. Find time to read *Designing Environments for Constructive Learning* by Duffy et al.

The chapters in this book explore the implications of a constructivist view for the design of learning environments and for the role of technology in that design. An examination of these chapters makes it clear that constructivism is not a unified point of view. There seems to be general agreement as to the importance of the authenticity of the learning task and the context in which the student works. There is also general agreement on the importance of collaborative learning as a means of developing a richer understanding through considering alternative perspectives.

Perhaps the greatest differences among cognitive scientists arise from focusing on constructivism as a learning theory or as a set of instructional strategies. As a learning theory, the focus of constructivism is on how we understand and what it means to understand. It is a lens through which we see the world: all learning is seen from a constructivist perspective. For even the most basic learning task, meaning is constructed and understanding occurs in context. There is no restriction on the instructional strategies that can be used. If drill and practice is the most efficient strategy for developing the

particular ability and understanding, then that is the instructional strategy that should be used. The critical issue is that the drill and practice occur in a context of a larger problem so that the learner sees the learning activity as a means of developing a skill that is needed. The criterion for success is the ability of the learner to use that skill in the larger context.

What we are proposing is not theory. The ideas Professor Stow and Principal Ashby will explain have been used by districts no more wealthy or sophisticated than your district. It doesn't require brilliant teachers or genius curriculum directors (although that would be nice!). This process means that in three short years you can have curriculum alignment in all subjects, pre- and post testing to get the diagnostic and accountability pay off, and formative assessment to assure opportunity to learn (OTL).

DISTRICTS COMPLETING SIM

Our original districts which served as the prototypes in SIM were Minneapolis, Edina, Northfield in Minnesota and Spirit Lake in Iowa. Breck School in Minneapolis was our independent school prototype. Since then the three year process has been used in Hot Springs County, Wyoming (with five years of achievement gains, Manatt and Holzman, 1991); Lincoln County, Wyoming; Monroe County, Florida; Valparaiso, Indiana; Gilbert Community Schools, Iowa; Maricopa County Accommodations Schools (Phoenix), Apache Junction, Cave Creek and Coolidge, all in Arizona.

Now Professor Stow will describe the curriculum renewal process [usually a three year cycle: (1) Language Arts, Reading and Mathematics; (2) Social Studies and Science; and (3) Fine Arts and Practical Arts]. Then Dave Ashby will explain how computer platforms put precision into the operations. We looked at 20 platforms in 1993-94 (Woodward, 1994). Dave will describe our experiences with the two best platforms in our study.

CURRICULUM RENEWAL

Curriculum renewal is a process of updating the infrastructure of the district. Curriculum must constantly correspond to change. However, this does no seem to be happening, because one of the basic issues school districts face today is that curricula are not sufficiently focused on, organized for, or adapted to the realities in which they operate. In essence, they are out-of - date.

During the curriculum review and development process time needs to be allocated for the representative K-12 committee(s) to meet, to discuss, and to reach consensus about issues within the content area being studied. Many elements will shape their decisions. High quality curriculum materials will be a synthesis of these elements, i.e. state frameworks or guidelines, data from tests, research on teaching and learning, the district's educational goals, and standards from the national associations.

By using this renewal process, the district will have a basis for all the decisions about curriculum and instructional practices. It will have a quality

control mechanism because the written/taught/tested curriculum will be aligned and will optimize learning for students.

REVIEW PROCESS

The review process is a critical task which is done prior to curriculum development. The committee reads and studies the literature, which includes selected reprints from journals and/or excerpts from texts. The committee members discuss the important ideas from each article or excerpt and generate a list.

One set of information used at this point would be the standards, whenever they are available from the scholarly society. For example, the National Council of Teachers for Mathematics identified their 13 standards and published them in 1989. Many committees readily accept the standards because they express an answer to the question - "How good is good enough?" for the curriculum being developed for learners moving into the next century. There are other committees who do not want to use the standards because they were not locally-developed and, if used, would cause many changes in the curriculum and instructional practices within the school district.

After a review of the literature has been done the committee discusses the current practices from Kindergarten through twelfth grade and generates a list of them. Next they are ready to compare the list from the literature with the current practices. This task identifies the "gaps". As the committee begins to develop the curriculum, these lists serve as reference points and very likely there will be "planned abandonment" occurring as they continue to develop the curriculum.

CURRICULUM DEVELOPMENT (Exhibit A)

A set of structured activities is used as the components of the Curriculum Development Framework are defined.

A. The philosophy or statement of beliefs about the content area is determined. Questions like "What beliefs about students should be used as a basis for curriculum development in this content area?"; "Why is this body of knowledge worthwhile?" will be discussed and a paragraph(s) will be written. This statement will be used as the foundation for future discussions.

B. Several strands or themes are identified and defined for the K-12 content area. These serve as categories or natural classifications and usually there are six or seven. Examples for Mathematics would be Operations (The Operations strand involves the study of addition, subtraction, multiplication, division.) and Numeration (The Numeration strand involves the study of number systems.). Examples in Language Arts would be Literature (The Literature strand promotes the development of reading as a tool for learning and provides experiences with a variety of literary forms.) and Study Skills (The Study Skills strand promotes the systematic development of the

Exhibit A

SIM Project

Curriculum Development Framework

Philosophy (Subject Area)

↓

Strands

↓

Program Goals

↓

Scope and Sequence
(Articulation format)

↓

Unit Plans

- *Learner Outcomes*
- *Evaluation Activities*
- *Suggested Activities*
- *Instructional Tools*

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ability to acquire knowledge, organize information, and utilize thinking skills.).

C. Program Goals are the general intents within each strand. Typically, there are 2-3 per strand. These are not measurable, are visionary/ guiding stars, and are nonspecific. For Mathematics an example could be "To understand the relationship of numbers to each other," while in Language Arts one could use "To understand a variety of literary forms."

D. The scope and sequence grids (Exhibit B) display the skills/ concepts taught within each program goal. The skills/concepts are generated through the brainstorming process. The grids are the "wheel that drives the whole process." They serve as a map for teachers to use while making their plans for various units of study. Examples of skills/concepts within the Mathematics program goal, "To understand the relationship of numbers to each other," could be ordinal numbers, place value, odd and even numbers, and expanded notation and in the Language Arts program goal, "To understand a variety of literary forms," they might be essay, short story, fiction and nonfiction, and basic story elements.

Lots of discussion occurs while the committee members work on the grids. It is a give-and-take discussion. Close attention needs to be paid to the symbols and their definitions as they are placed on the grids. These symbols are (1) Introduce (I) = to teach formally for the first time, (2) Expand (E) = to build upon the skill/concept in a sequential manner, (3) Mastery (M) = to require demonstration of the use of a skill/concept correctly 80% of the time, and (4) Maintain Mastery (MM) = to require application of previously mastered skills/concepts with materials of increasing difficulty, or (5) Reinforce (R) = to provide instruction which will assist in maintaining mastery while utilizing previous learning. The I, E, M, and MM or R indicate the Level of Learning or the "extent" to which one teaches.

E. The component labeled Unit Plans consists of four subsets of information, i.e., (1) Learner Outcomes, (2) Evaluation Activities, (3) Teacher and Student Activities and (4) Instructional Resources. Only the first two will be discussed.

(1) Each Learner Outcome (objective) is written by using the Elements of the Golden Triangle or (a) an observable behavior, (b) conditions of learning, and (c) criterion measure. Using the analogy of a triangle reinforces the use of these three elements when writing the statement which defines WHAT will be taught/ learned. The observable behavior states how the learner will perform when the learning is exhibited (writes, draws, charts,

SUBJECT: MATHEMATICS
STRAND: Pattern and Relations
PROGRAM GOAL: #15 To recognize, describe, and create patterns and relations.

	K	1	2	3	4	5	6	TrMa	Alg	Geo	Ad Alg	Pre Cal	Cal
.01 Analyze and generate patterns	I	E	E	E	E	M	MM	MM					
		I	E	M	R								
.02 Skip count	I	E	E	E	E	E	E	E	E	M	MM	MM	MM
.03 Patterns in nature		I	E	E	E	E	E	M	MM	MM			
.04 Organization of data									I	E	E	M	MM
.05 Problems using functions													

SAMPLE

I = Introduce E = Expand M = Mastery Expected R = Reinforce MM = Mastery Maintained

TrMa = Transitional Mathematics
Alg = Algebra
Geo = Geometry
Ad Alg = Advanced Algebra
Pre Cal = Pre-Calculus
Cal = Calculus

EXHIBIT B 12

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maps). Conditions of learning provide the circumstances under which the behavior will be demonstrated (given a ruler; given two figures that represent fractions through twentieth; given a list of 15 words). The criterion measure indicates what will be acceptable as evidence the learner has achieved the learner outcome (five characteristics; weighed to the nearest gram; correctly; four out of five). As the learner outcomes are written each shows a specified level of Bloom's Taxonomy and the Level of Learning. When writing learner outcomes be S M A R T (or specific; measurable; attainable; relevant; trackable). This acronym helps keep the committee members working on well - written statements.

(2) The Criterion-Referenced Measures (CRM) Evaluation Activities (Assessment Techniques) belong in two categories - Traditional (or the paper-and-pencil type) and Nontraditional (or those which are performance-based, product, portfolio, or personal communication). The focus for this paper is on one of the traditional techniques, multiple-choice tests. This type of test is the most widely used objective test and the most versatile. These test items can measure all levels of Bloom's Taxonomy and a substantive amount of learning can be sampled in a relatively short time.

To provide direction for the CRM Developers, test specifications need to be defined. This is a reduction process which displays the relative importance of all learner outcomes which have been written. This planned focus will move everyone in the same direction within the teaching/learning setting.

Prior to writing CRMs a common language about testing, guidelines for writing stems and foils, the process for writing items, and materials needed to write test items are reviewed.

The discussion which develops a common language centers around a definition for each of these (a) test item, (b) stem, (c) foil, (d) distractors, (e) validity, (f) reliability, (g) formative, and (h) summative. All of these terms play an important role when writing test items.

Guidelines for CRM Developers to think about as they write stems include (a) focusing on a learner outcome, (b) providing a sample of ALL the learning, (c) using a question instead of a "blank" in the stem, (d) avoiding negatively worded stems, and (e) being concise along with being grammatically correct. Guidelines for writing foils stress (a) avoiding clues, (b) using four choices, (c) writing them grammatically correct, and (d) avoiding such choices as "none of the above", "all of the above", "not given", and "not enough information".

The process for writing items includes beginning with the learner outcomes which have a Level of Learning labeled "mastery" and then moving to those with labels of introduce, expand, and maintain mastery (or reinforce). (At the lower grade levels there may not be anything at mastery so the writers

begin at another level.) When creating the stem on the Test Item Development Form, write the stem and the correct foil first. This should read as a complete thought. Next, write the three distractors which are the logical but wrong answers. Each distractor should be written after the CRM Developer has determined WHY it was chosen.

Materials needed to write test items are the (1) test specifications, (2) test item development forms, (3) scope and sequence grids, and (4) learner outcomes for which the items are to be written.

A recommendation for the number of items for the pre/posttest would be 25 items K-1-2, 35 for 3-4-5, 45 for 6-7-8, and 60 for 9-12. The CRM Developers should write many more than those recommended because each test will be field-tested and some items will not withstand this process. Plus any "extras" can be placed in a bank of items so there will be alternatives from which to choose.

Most tests will have some type of graphic(s) in them. Some of these are computer - generated while others are sketched by a graphic artist. It is always wise to ask "Does the art work contribute to helping the learner answer the item(s)?"

Code numbers are used to connect all sections of the system together. Information found in the code includes subject area - grade level/course - strand - program goal - skill/concept - test item number matched to a specific learner outcome - Bloom's Taxonomy - Level of Learning. These details are used when reports showing test results are generated.

Several drafts of the curriculum and tests are written over time in order to make them "just right." The well-defined five step "Writing Process" from the Bay Writing Project is discussed with committees as it relates to curriculum development. In this process Step One or Prewriting is the preparation time when ideas are generated, options are considered, and patterns are framed in the mind. These are used when the Philosophy, Strands, Program Goals, and Scope and Sequence Grids are developed. Step two, Drafting, is the early version of the learner outcomes and test items. Revising, step three, is the delicate reworking of the written materials by using a critiquing process. Step four, Editing, is adding, deleting, moving, combining, or substituting one learner outcome or test item for another. Publishing, step five, is when the materials are disseminated so they can be implemented. At this point a leadership cadre of teachers is ready to teach those teachers who will be implementing the materials, but were not involved in the developmental process. This cadre will teach others what the newly-developed curriculum and tests are all about. Our experiences have shown this is a very successful way to accomplish this task.

In summary, the curriculum and criterion-referenced measures become the foundation for the teaching/learning process and serve as the district - specified blueprint. This user-friendly set of board-adopted materials defines affirmatively: "of all that could be taught/learned/tested, these are what are important in this district." Without such a plan, learning is left to chance and

worthwhile learning is achieved by accident or default, not by intention or design.

PRECISION AND THE CURRICULUM

Dr. Manatt and Dr. Stow have shown you a capsule of what it takes for proper curriculum design, including planning, articulation, assessment, selection and writing. What they suggest is a prerequisite to the next step. It is the next step that, unfortunately, rarely gets implemented. Too often the results of the curriculum development effort end up in a big thick notebook that sits on the curriculum coordinator's or the principal's shelf. Occasionally it finds its way to the teacher's shelf, but too many times, the adopted textbook series becomes the "real" curriculum guide instead of a resource.

A great deal of effort goes into deciding what is to be taught as well as the instructional process that follows the planning. Teachers spend a lot of time checking tests which they assume assess what was learned from what they taught. Sometimes the test items match the curriculum and instruction and sometimes they don't. To develop some kind of structured system for accountability, teachers will create logs, checklists, databases, or spreadsheets. However, that is a monstrous, time consuming job when doing it without the use of technology. This is where a computerized curriculum management system is needed. This does not mean that the contents of the big thick curriculum book are just typed into a computer that has a hard drive, because nothing is gained from that.

There needs to be precision management of all the information relating to the planning, teaching, and assessment of the curriculum. A good management system provides that. It ties the outcomes (expectations), the objectives/goals, the knowledge strands, the individual lesson objectives, the learning hierarchy, and the assessment items together. Several loose ends may get tied together nicely with a management system. A good management system will not allow assessment items that have no objective tied to them. It will not allow objectives to be taught that are never evaluated.

"It's what's up front that counts" could be a motto for the Gilbert Elementary School with regard to management systems. A partnership with Iowa State University, The NCS Corporation, and Gilbert Community Schools has provided an opportunity for evaluation and demonstration of an established management system called Performance Plus ©, and now we are implementing "ABACUS" which is NCS's acquisition to upgrade the quality of their management product line.

The up-front work is the hardest and most time consuming. Developing the curriculum is aligning the goals and objectives to assessment items and takes a lot of time and work. But, once all this is in the system, the payback for the time and work starts. Quick and easy access to the developed curriculum, quick easy scoring of tests, pages of reports for parents, students, teachers, administrators and quick feedback for all concerned are the benefits. Comparison between students, item analysis of tests, progress reports which

have meaning (unlike the traditional letter grades) so parents can understand are all valuable tools. The quick results make it easy for teachers to design their reteaching loops while teachers without management systems are spending hours checking test papers by hand.

Curriculum revision comes about as a result of the assessments. Assessment drives the curriculum. The curriculum becomes a living, evolving, accessible entity instead of a big thick book on a shelf. When you know what was planned, what was taught, and what was assessed, changes are much easier. Having a precise handle on what students know and don't know allows precision modification.

In an ideal situation in a school, all teachers would have network access to the management system. This moves the big thick book to the teachers' desks. Teachers can easily get various reports on student progress or quick access to curriculum statements, objectives, and test item banks. The teachers would have access to a large selection of valid, reliable, test items. No need to worry about whether the students have the test, just print a new one that is just as valid and reliable with all new questions. Make-up tests and test retakes could be handled the same way. The superintendent smiles when he/she receives the printed report of how students are progressing towards established outcomes and puts the information on the required state report.

The basic components of a management system are student/ demographic information, course and teacher assignment, curriculum information, test development/item banks, and report. There is, of course, programming for scanning score sheets, including graphics on test items, printing of reports, and transferring data. Assessments are not limited to "bubble" sheets. Performance observation, building of portfolios of all kinds of information, and other measurement techniques should be built in. A good systems allows flexibility in report design to meet school needs. Data can be pulled out relating to equity issues, and other things that might bias performance.

The start-up cost for the software for a management system can be expensive, but the payout is worthwhile. The cost is $5,000 or more for a small school. The cost of computers, networking, file servers, printers, and terminals comes in addition to the cost of the software. It may be necessary to have a clerical position to input data and score tests. A lot can be done for the price equal to that of a new school bus.

Having a management system has been an awakening experience at Gilbert Elementary School. As teachers pulled objectives from their developed curriculum guide and began to fit them into the hierarchical structure in the management system they began to find out that what they had written down was not necessarily what they were teaching. They were forced, by the system, to restructure the goals and objectives to match what was really going on because the system forces the assessment items to match. Teachers began to split broad objectives/goals apart into more specific statements. In other words, when the teachers could actually see their curriculum structure, they found they needed to change it to fit their teaching. Of course, they can't

capriciously change their curriculum. The old established system (the curriculum coordinator, the principal, established curriculum development procedures, and the Board of Education policy book) prevents that.

Teachers found that the textbook tests did not necessarily match what was taught and they became skeptical of the "canned" curriculum. They turned back to what had been designed by them. The teachers discovered test items on objectives that were not taught or tested. There are many high - quality published instructional materials and they are valuable resources when used appropriately. But, when it comes to deciding what needs to be taught, at least in Iowa, the local school district wants the authority.

We are not denying that it takes a lot of time and work to get the curriculum into shape. Dr. Manatt and Dr. Stow do not visit a school for a couple of days and then disappear. They take on projects that last several years. But, when their work is done, and with the curriculum in a management system, the curriculum becomes easier to revise and the output from the system pays back for the time and work put in. A typical example would be:

> A Gilbert 6th grade science teacher asked for a test. The system operator hands the teacher the test within 15 minutes, including the scanforms, the answer key, and a list of the objectives to which each test item is tied. The test is given and the answer sheets are fed into the scanner. In another 15 minutes, the tests are scored (for two class sections) and the results are handed to the teacher. The "results" package is delivered to the students and then to the parents. This packet includes the scanforms, the test booklet, a printout which shows how each student did on each test item and the percentage of mastery by objective. Also included is a class summary showing how the class or grade did by objective. This allows parents to compare their own student's performance to that of the class. In addition, the teacher gets a graphic printout of correct and incorrect answers by student and an item analysis of the test. At the end of the year or semester, the superintendent and curriculum coordinator receive a large printout of student progress toward all the objectives in all the subjects. It becomes very easy to spot the successes and the trouble spots. The results are quick. The only hazard would be if the results are treated like some treat the results of standardized tests. A pile of computer printouts goes on the shelf next to the dusty curriculum guide. The quality teacher will, at a glance, know what has been mastered and which students need to follow the reteaching loop and then acts on the information.

The high school teachers will ask, "How can you send the test home? The students will have my test." We don't see that as a problem. A good test generator will mix up the answers and mix up the questions in several different

forms of the same test. It is also fairly easy to select a complete new test from a bank of many hundreds of proven reliable and valid items. If the students still perform very well on the test, then the teacher has a clue that perhaps time should be spent teaching other things because these specific objectives have been mastered.

Recently, Gilbert Elementary teachers have asked for a printout of the objectives before they select the test or items for a test. When the building is networked, the teachers will do that via the terminal on their desk.

Test item design is an area where Dr. Stow and Dr. Manatt spend a lot of time. The Gilbert Elementary teachers are learning about the diagnostic value of the foils that accompany the multiple choice items. Now, with ABACUS, performance observation and portfolio development are new areas we explored. "Bubble sheets" are not the only assessment tool. First graders don't do well on bubble sheets.

A final comment about an unanticipated result of a computerized management system. This is quickly observable by an administrator and is now being noticed by the teachers. Something positive happens to teachers' confidence when they use such a system. They always thought they knew what they were doing. Now they can demonstrate it. Something positive happens to teachers when they realize that their curriculum design time was not a waste. The teachers taught what they planned to teach and the assessment tested what they taught. The results drive what happens next. "They have it learned or we go back and hit it again" is a comment heard over and over again. This is the essence of criterion assessment. Standards are established and we work at it until we get there. Some students just take longer. There is no requirement that a certain percentage fail. The ownership goes back to the students. We are here to help them. They do the work. We help them learn. When teachers have this new confidence it transfers to students. The teachers know what they are doing. The students know what they need to learn. No guessing what the teachers want the students to remember. There are no tests that have "tricks" in them to be sure that no one gets all the answers correct. It is all up-front and the teachers and students attack it together.

Businesses for many years have held themselves accountable for their products because it is a matter of survival. They spend the money and make the commitment to manage their production to keep themselves competitive. It is now becoming a matter of survival for schools to be able to precisely report to their constituents how the schools are doing with regard to teaching and learning. Many parents now have the option to pick a school of their choice via open enrollment. Private schools say that they can do it better. The media happily announces that the rest of the world is doing better in education. That is pressure to change.

Is it possible that many schools really have improved, but lack the vehicle to communicate this improvement to their public? Parents assume letter grades mean something. We are happy to give them information that is more meaningful. Why not tell parents and students what is expected and

then give them detailed reports of student and school system progress towards those expectations? Sounds great, but manually, the handling of the data and information is impossible. A good management system is the tool.

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